CCS3000 USER MANUAL

Horizon

Infrastructure

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1 Introduction

Thank you for choosing MoistTech.com, a division of Sensortech Systems, Inc., as your moisture measurement provider. The CCS3000 is the most sophisticated on-line FOR sensor available, offering unmatched accuracy and reliability at a very affordable cost.

The CCS3000is a “smart” sensor with all measurement, signal processing and control functions self-contained. It features multiple standard I/O including two isolated 4-20mA outputs and one non-isolated, self-powered 4-20mA output, RS232/RS422/RS485 serial communications and Ethernet (TCP/IP & UDP). Optional communications are provided by plug-in module and include DeviceNet®, Profibus® and many more.

This manual is intended for the first-time user, providing information on installation and wiring, simple configuration and basic calibration.

For more detailed information, please consult the factory or local representative.

2 Getting Started

This chapter covers the mechanical installation of an CCS3000in its simplest configuration:

- *Single CCS3000FOR moisture sensor (FORG)*
- *4 – 20mA Remote display.*

2.1 Unpacking

The CCS3000is securely packaged in a custom urethane foam-lined carton along with all accessories. Compare contents with packing list and ensure all items are accounted for. If any items are missing or damaged, please contact factory immediately for further instructions.

2.2 Physical Installation

The CCS3000includes two (2) removable mounting brackets. These brackets may be configured in numerous ways to provide flexible mounting options. The most common configuration, the one provided from the factory, is a vertical mounting with the two mounting clamps positioned on the connector-end of the gauge. Figure 2 illustrates this mounting configuration.

Mounting brackets are designed to clamp on a diameter of 1.25” – 1.3” (~32mm) metal bar. Due to the many variables associated with any process environment, it may be more convenient to use a horizontal mounting bar. In this case the mounting clamps need to be relocated using the four mounting holes on the top of the instrument housing. The four holes form a square pattern, allowing clamps to be mounted in either of two positions, at 90° orientation. Figure 3 shows several possible mounting configurations.

The most important mounting consideration is the distance from product to sensor. The sensor

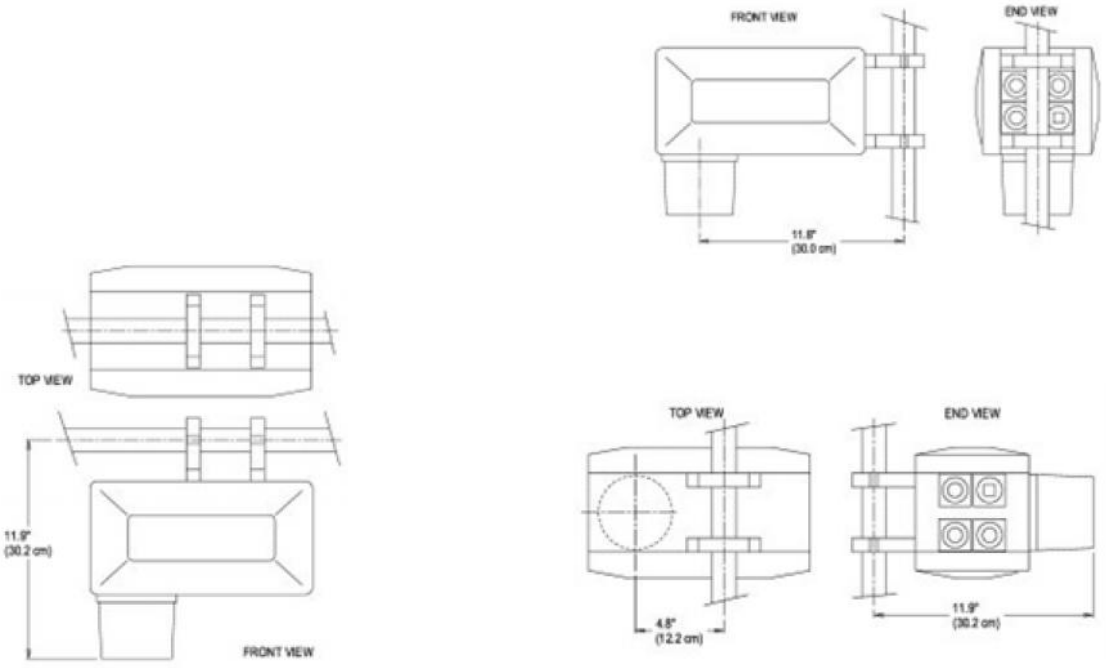

Figure 1 Gauge Mounting Configurations

may be equipped with an air-purge nozzle (light tube option) approximately 4" (100mm) long. This nozzle is generally recommended to keep gauge window clean, even when not using air.

Although the gauge will operate effectively in many applications at distances of 4" – 24" (100mm – 600mm), the optimum distance for most applications is 6" – 10" (150mm – 250mm) or 2" – 6" from end of light tube.

Highly reflective products, such as glossy paper, produce first surface reflections detrimental to measurement. Setting the gauge at a slight angle from vertical may easily eliminate these reflections. Typically an angle of 15° - 20° from vertical is recommended.

If air-purge nozzle or cooling panel option is used, a good supply of clean/dry air is required. An air filter and regulator located close to the gauge is recommended. Vortex air cooler requires air pressure of 80 – 100psi at flow rate of 4 – 8 cfm depending on vortex rating. Air-purge nozzle requires very low pressure (~5psi) and flow rate. See options chapter for more detailed information.

2.3 Electrical Connections

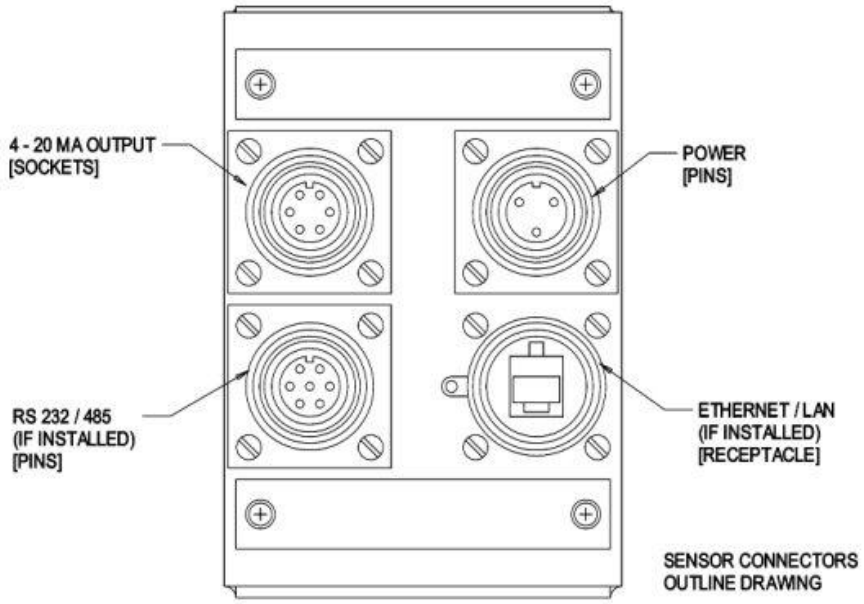

Figure 2 Gauge Connections

Figure 4 shows the rear connector panel of the moisture gauge. For detailed wiring descriptions, refer to chapter 6. The power connector in the upper right contains live, neutral and safety ground connections. The instrument is designed to operate from 85 – 260vac, 50/60Hz. If a pneumatic sampler option is supplied, an additional 3-pin socket is located on the bottom of gauge body. This provides switched ac mains to the air-purge solenoid in the sampler. A 6-foot (2m) power cord is supplied with the instrument with power plug appropriate to country of operation. In some cases, only the Bulgin connector is supplied.

Remote display is connected to self-powered, non-isolated 4-20mA output #1 (see figure 5). Any third party 4-20mA display may be used for remote readout. Sensortech provides 4 ½ digit LCD and LED optional displays. If the led version is chosen, typically for low light viewing conditions, then separate 5vdc power is required to the display. For displays mounted more than 12 feet from gauge, an isolated loop is recommended (loops #2 or #3). The isolated loops require external power (24vdc recommended).

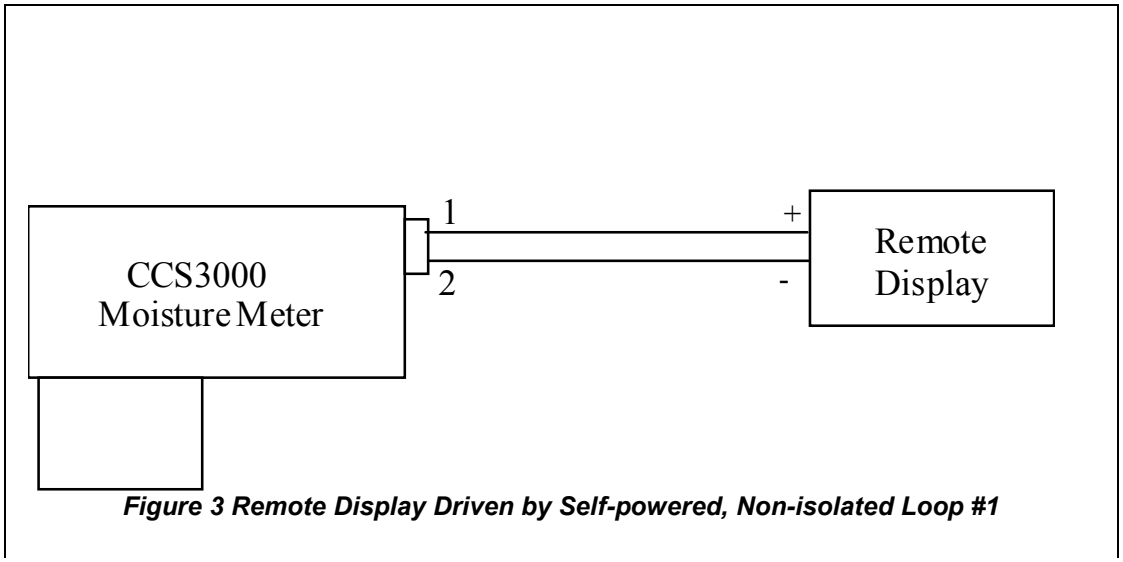

Figure 3 Remote Display Driven by Self-powered, Non-isolated Loop #1

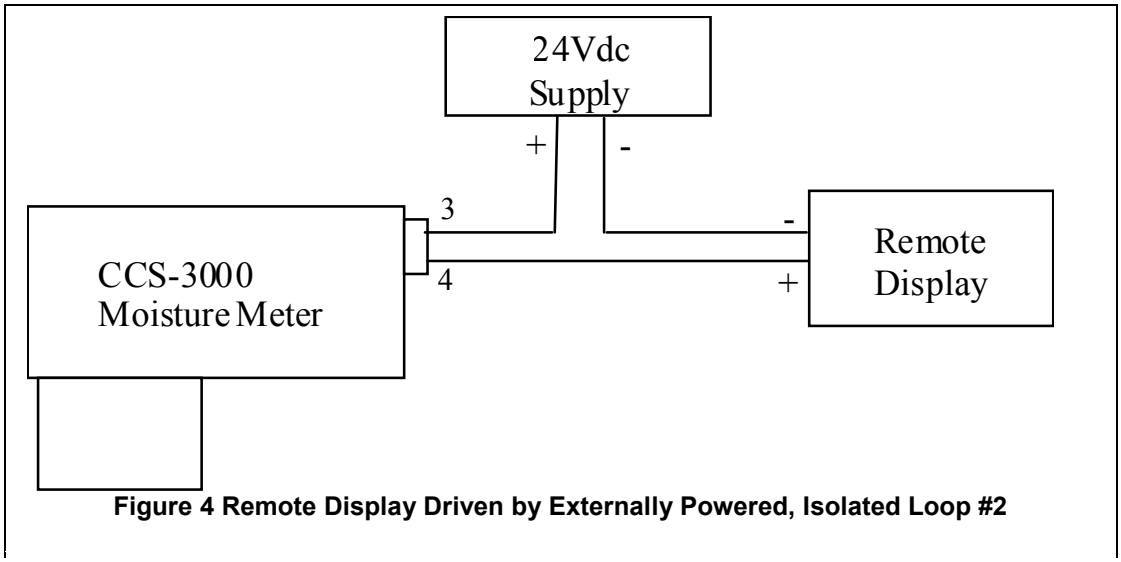

Figure 4 Remote Display Driven by Externally Powered, Isolated Loop #2

3 PC Configuration Software

A compact disc is included with the gauge. This CD contains various software to facilitate sensor configuration. PC configuration software is contained in a folder labeled 'IR3000 Configuration'. From this folder, run Setup.exe and follow installation instructions.

If any earlier versions of MoistTech software are installed, they should be detected during the setup procedure and removed. It is recommended to remove any earlier known versions prior to setup.

At the completion of software installation, an icon will be placed on the desktop. Double clicking the icon will start the configuration program and display the screen shown in figure 7.

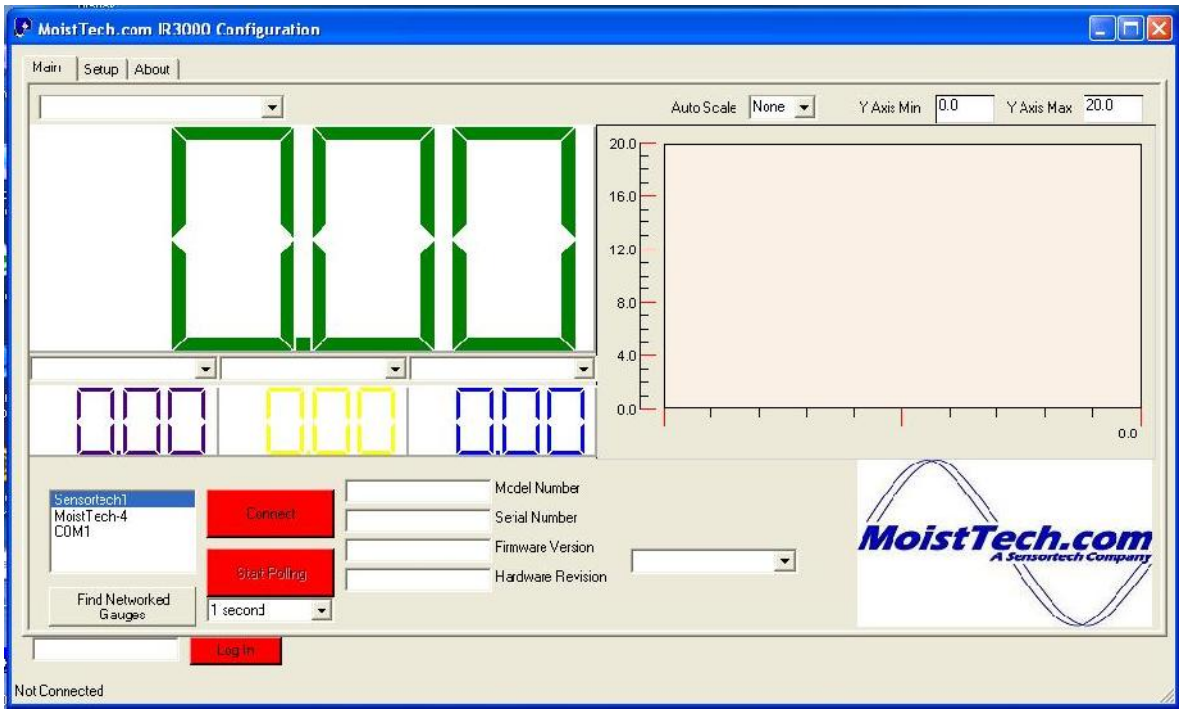

Figure 5 Main Start Up Screen

All gauges connected to host PC will be displayed in the lower left box. To communicate with a specific gauge, highlight that gauge by clicking on the name in the lower left box and then pressing 'Connect'. At this point the information fields immediately right of the 'Connect' button should be filled with the appropriate data associated with the connected gauge.

To display moisture and commence time plot, press 'Start Polling'. At this point the large display will indicate a moisture value and the trend plot in the right screen area will begin to scroll (see figure 8).

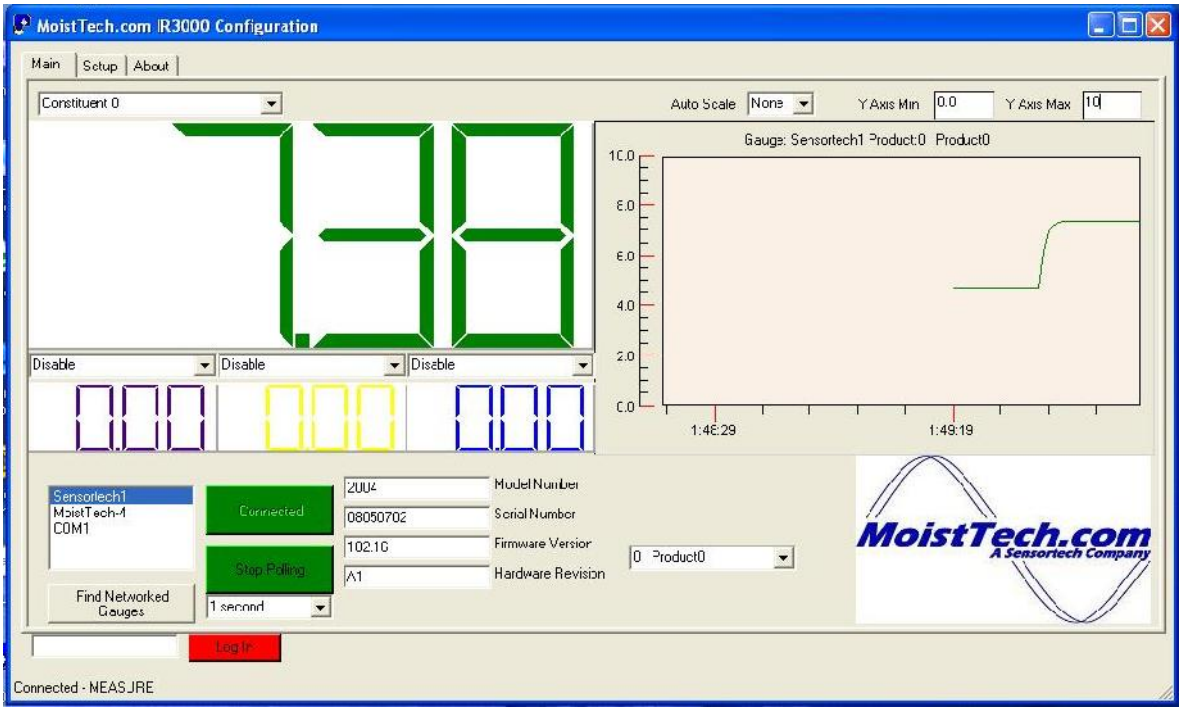

Figure 6 Main Screen After Connecting and Polling

Important Note: This software is only for gauge configuration. It is not intended as an HMI or logging program. For continuous monitoring of the gauge(s), MoistTech provides an operator interface option and also gauge monitoring software for continuous PC monitoring.

If the gauge has been pre-calibrated by MoistTech, then at this point it is ready to measure.

The remaining configuration functions set specific I/O parameters, product names, calibration parameters etc…

3.1 Password

At startup, the main screen shows three tabs in the upper left, namely: Main, Setup, About. The 'Setup' screen provides limited access to change only the alarm levels and constituent name (see figure 9). Further functions are password protected for security. The factory default password is 'engpass'. From the Setup screen it is possible to create new user passwords, but the factory default will always work.

Entering the appropriate password enables more tabs at the top of screen for access to additional functions, namely: Configuration and Calibration.

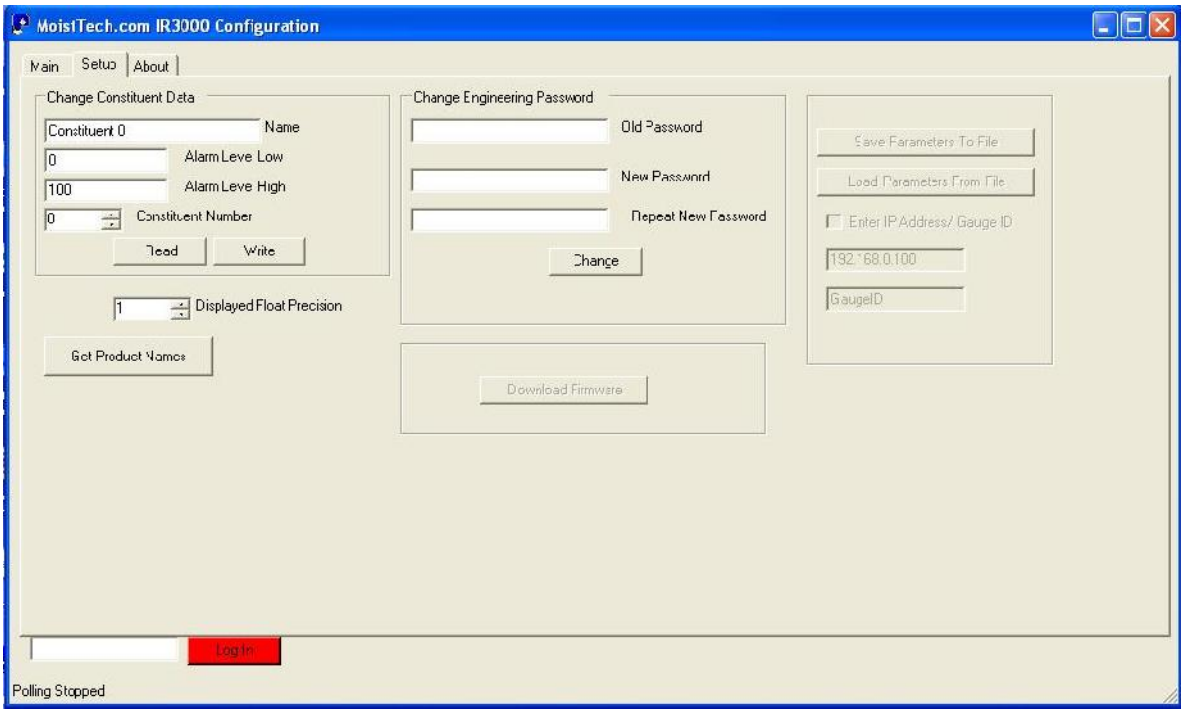

Figure 7 Basic Setup Screen

3.2 Configuration

After entering password, click on 'Configuration' tab, the measurement configuration screen shown in figure 10 will be displayed.

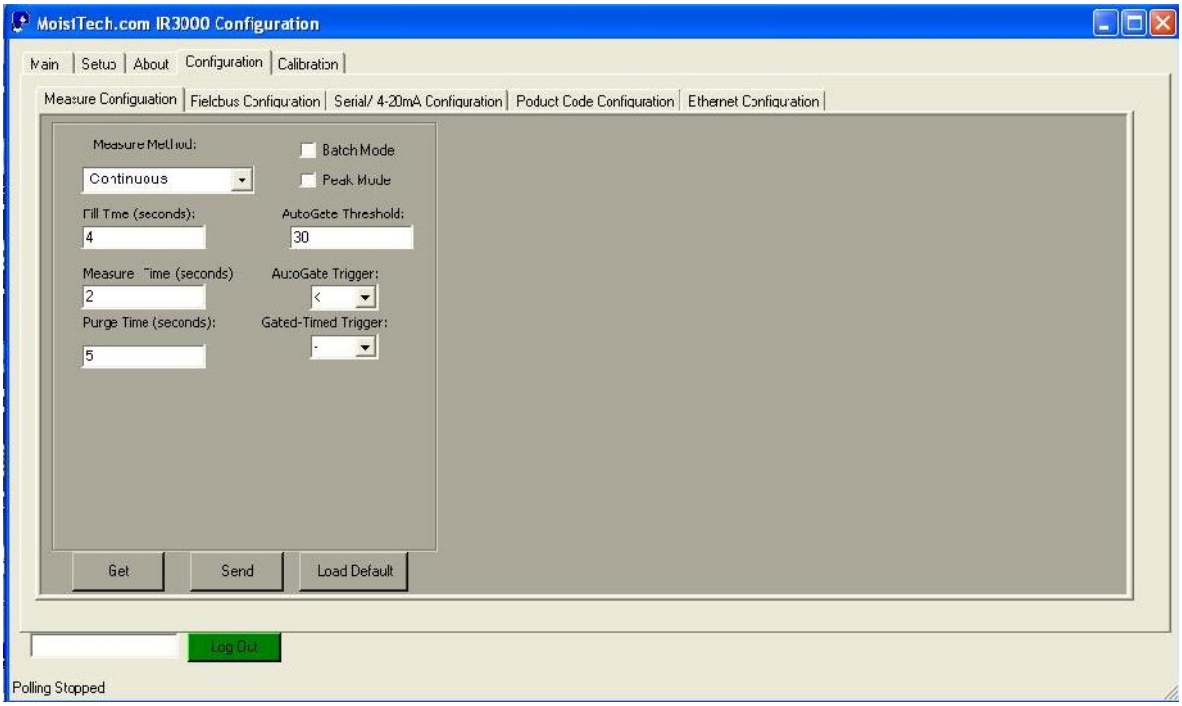

Figure 8 Measurement Configuration Screen

Measurement Configuration allows the user to select the mode of measurement and to set various parameters associated with this mode.

3.2.1 Measurement Modes

The CCS3000operates in numerous different modes, namely:

1. Continuous – Gauge measures continuously
2. Signal Gated – A true logic input enables measurement. A false logic input disables measurement and the last measurement is held.
3. Auto Gated – Similar to signal gated, but gating is enabled by moisture level. A threshold is programmed and the 'auto-gate trigger' is selectable for less than or greater than threshold.
4. Timed Sample – This is used when a sampling device is attached to the gauge. Programmable functions for this mode include fill-time, measurement-time and purge-time.
5. Gated Timed – In this mode, an external logic input enables measurement for a timed interval. This interval is set by measurement-time.

3.2.2 Fieldbus Configuration

Configuration of serial ports. Consult factory or local representative for more details.

3.2.3 Serial/4-20mA Configuration

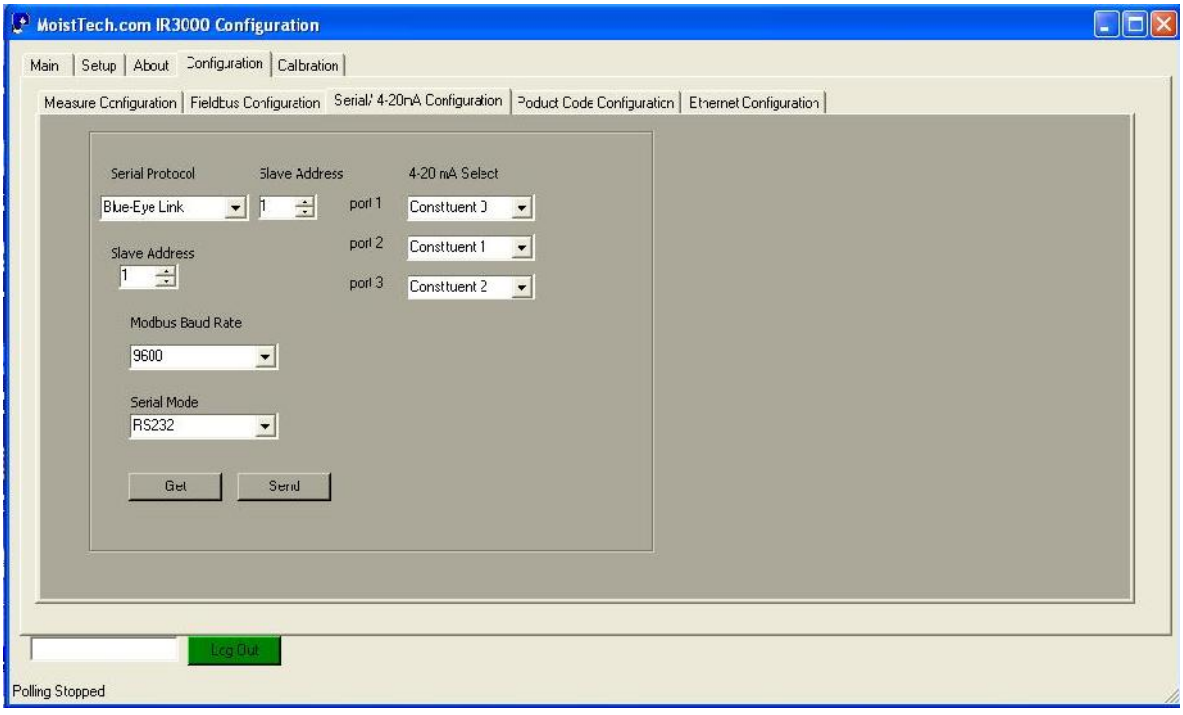

Figure 9 Serial/4-20mA Configuration Screen

The serial/4-20mA configuration screen selects serial I/O parameters and allocates measured constituents to specific analog outputs. For a single constituent gauge (e.g. Moisture only), it is possible to configure all three analog outputs to represent the one moisture measurement. If moisture and temperature are being measured it is possible to output moisture to analog outputs 1&2 and temperature to output 3. This would provide a non-isolated moisture output to a closely positioned remote display while driving an isolated output to a more distant PLC input.

3.2.4 Product Code Configuration

The CCS3000sensor stores up to 50 product codes within the on-board flash memory. Product code configuration is divided into three screens. The first screen, 'General Parameters' is shown in figure 12. General parameters are those common to all product codes and include:

1. Constituent name
2. 4-20mA range
3. Auto-Gate trip level
4. K coefficients

If any parameters are changed, remember to 'send' to gauge in order for the changes to take effect.

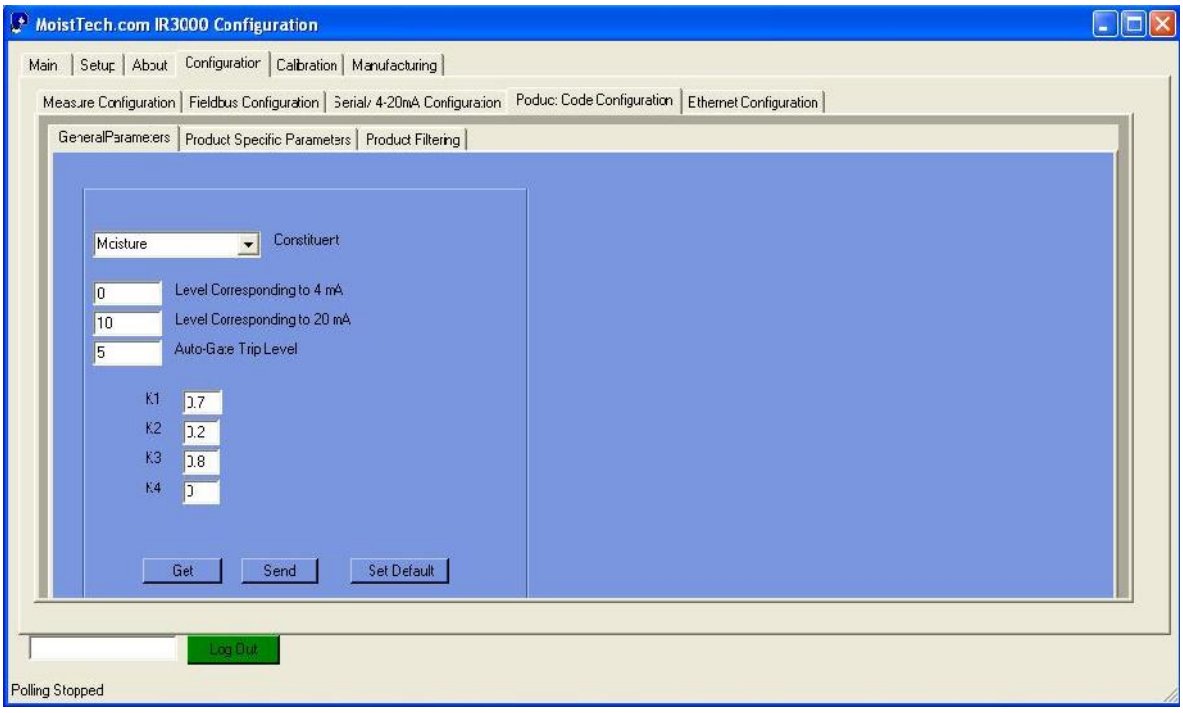

Figure 10 Product Code Configuration - General Parameters

The 'Product Specific Parameters' screen is shown in figure 13. Each displayed parameter is specific to a product code or product calibration. The first parameter is the product name. If no name is given, then default label is 'Product Code x', where x = 1 through 50. Product name is changed in the lower 'product name' box.

Associated with each product is a set of calibration coefficients ‘a’, ‘b’ & ‘c’. For more detailed explanation of coefficients, see chapter 4.

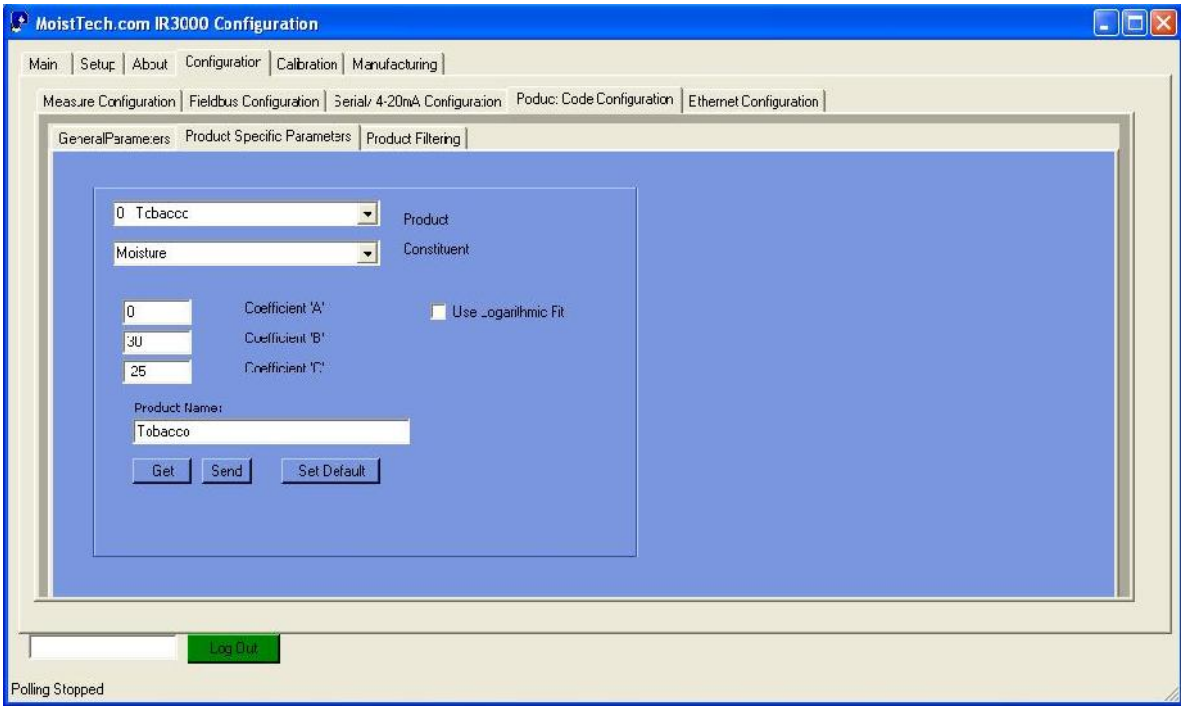

Figure 11 Product Specific Parameters

Coefficient ‘a’ is always zero unless a quadratic curve fit is used. This is for more advanced users and is covered in more depth in the technical manual.

Coefficient ‘b’ is the slope of the calibration line. A higher ‘b’ value increases instrument sensitivity to moisture. In most cases the instrument will be pre-calibrated prior to shipping and a suitable ‘b’ value will be installed.

Coefficient ‘c’ is an offset coefficient and may be positive or negative. When the instrument-displayed values are compared to laboratory analyses (grab samples), the ‘c’ coefficient is used to correct for an average bias in the instrument. For example, if the average of 10 laboratory samples is 0.7% lower than the average instrument display corresponding to those 10 samples, then the ‘c’ coefficient needs decreasing by 0.7.

A calibration program is contained in the configuration software and will be explained in more detail in chapter 6.

3.2.5 Product Filtering

There are three levels of signal filtering within the gauge. Wheel rotation averaging is factory set for a specific application and effectively determines the sample update rate. If this needs to be changed, consult the factory for instructions. Median filtering is another factory set parameter and should only be changed by a factory-authorized technician.

The third filtering technique is ‘Damping’ and is user programmable. Damping performs a running average on the real-time data. For example, if a damping value of 10 is chosen, then a software buffer is generated containing the last 10 sample updates. The instrument value displayed is the average of the data in the buffer. The sample update rate is not affected by the damping value, but the displayed value is a running average of the last ‘n’ samples. Damping has a smoothing effect on the instrument response, but will slow the response to moisture changes. Large step changes in a process are unusual, but may happen during transitional periods such as process start-ups. With heavy damping, a step change will normally take time to reach final value. The CCS3000contains a programmable filter band where any moisture changes within this band have damping applied. Changes exceeding the filter band bypass the damping function. In this way, small steady-state fluctuations are smoothed by damping, but major disturbances are immediately displayed.

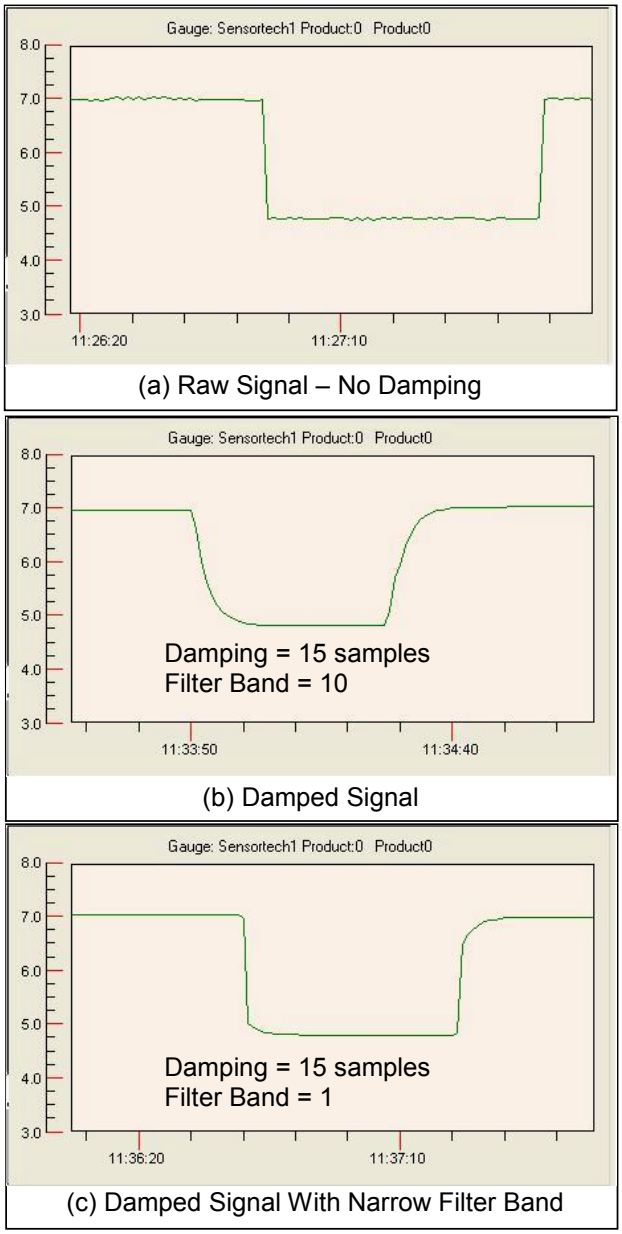

Figure 12 Effects of Damping & Filter Band

3.2.6 Ethernet Configuration

The Ethernet configuration screen is shown in figure 15.

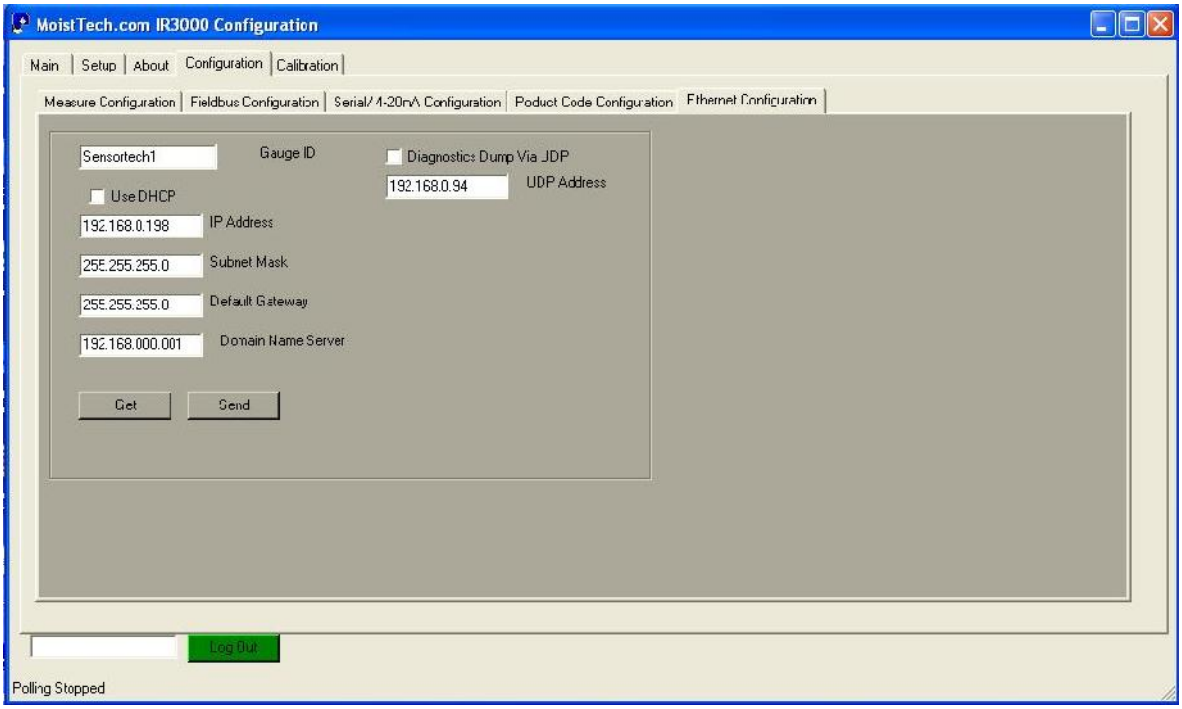

Figure 13 Ethernet Configuration

The CCS3000sensor is equipped with multiple communications capability. The most powerful communications feature is the TCP/IP Ethernet port. This feature is standard on all CCS3000series instruments and provides the highest data speed with the most comprehensive data access.

If the sensor is connected to a DHCP server-based network, then the DHCP box may be checked in the Ethernet configuration screen for the gauge and in the network settings for the PC. Dynamic Host Configuration Protocol (DHCP) basically assigns suitable IP addresses to all devices on the network at time of boot up.

Many factory networks use fixed IP addresses. In this case, a competent IT professional should assign the addresses to the gauge.

The configuration screen shown in figure 15 initially reads the LAN related parameters from the gauge. These parameters may be modified and then re-sent to the gauge.

MoistTech has a comprehensive diagnostics program to run on the LAN network. This program uses UDP (User Datagram Protocol), which differs from TCP/IP in that it largely ignores errors, but provides a very rapid transfer of large blocks of data. If the diagnostics program is to be run, the UDP box should be checked and the appropriate IP address of the receiving PC should be entered in the UDP address box.

4 Calibration

A major feature of the configuration program is the calibration software. This provides the capability of grabbing a sample from the process at the same time that the gauge is recording a measurement.

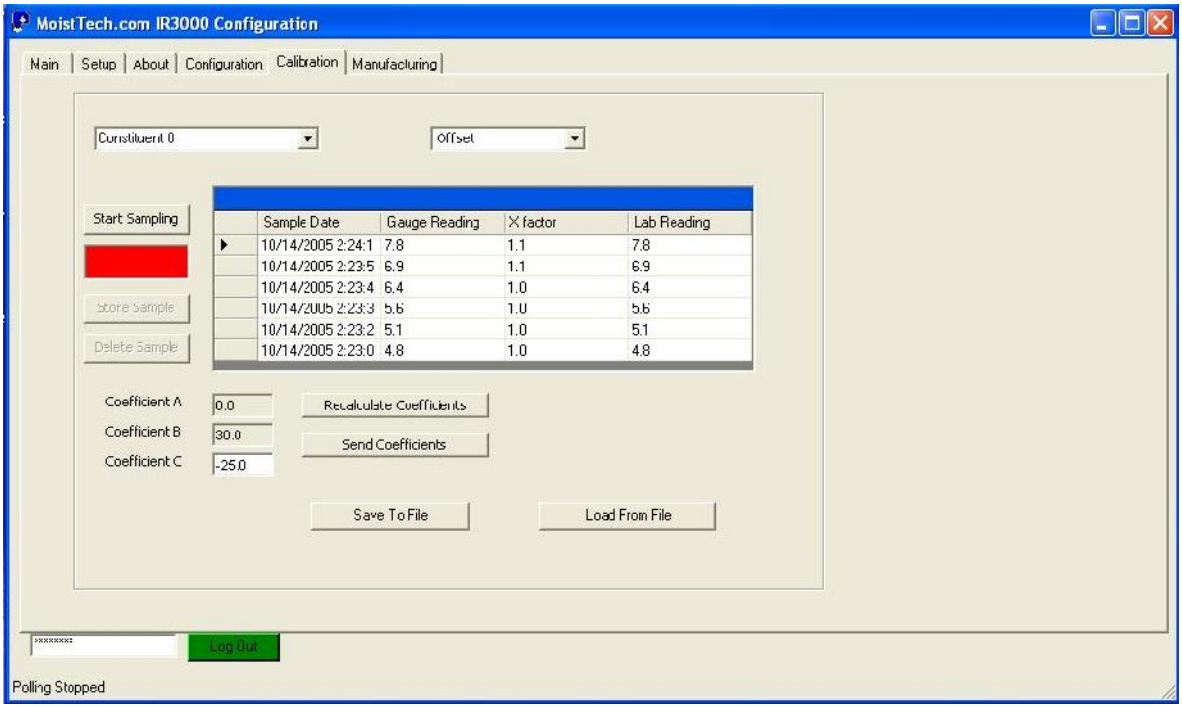

Figure 14 Calibration Screen

The calibration procedure comprises pressing the 'start sampling' button in the upper left of screen, taking a sample from the process in close proximity to the gauge, and then pressing the 'stop sampling' button. Each time this button is pressed, it will toggle between start and stop. After taking a sample, the 'store sample' button will be highlighted and the average instrument reading between start and stop sampling is displayed. Pressing this button will store this value in the table to the right. Each sample has an associated time and date stamp to facilitate sample matching.

4.1.1 Offset Method

The simplest calibration is the 'offset' method. This method assumes that the gauge has been previously calibrated and the calibration slope is approximately right. After inputting the samples to the calibration table and having performed a laboratory analysis on the corresponding samples, the laboratory values may be edited into the table. Locating cursor over appropriate lab value, highlighting that value and entering new lab value, does this. When all lab values have been entered into the table, press the 'Recalculate Coefficients' button. The average instrument and lab values are calculated and the 'c' coefficient is updated according to the average error. Nothing is changed in the instrument until the 'Send Coefficients' button is pressed. The data may also be saved to a file for future amendment.

Historic data may be handled by loading a data file (containing historic samples), amending it with current data and then calculating the error over the entire range of data.

The upper center of screen displays the calibration algorithm to be used. Four calibration methods are featured, namely linear, quadratic, logarithmic and offset. Only linear and offset will be dealt with in this chapter. More advanced users should consult the technical manual.

Highlighting the data row and pressing the ‘delete’ button may delete invalid samples.

Caution: Deleted samples are not recoverable. It is recommended to save the raw data to a file prior to editing.

4.1.2 Linear Regression

Linear regression is a statistical program that establishes the direct correlation between two data series. A correlation coefficient indicates the quality of correlation. This value is between 0 and 1, with 1 being a perfect correlation. In addition to determining the quality of fit, the regression program calculates the slope and intercept of the calibration line. These two values are the ‘b’ and ‘c’ coefficients respectively.

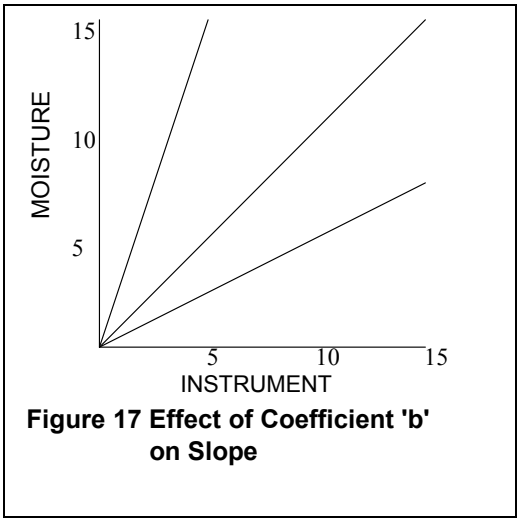

Figure 17 Effect of Coefficient 'b' on Slope

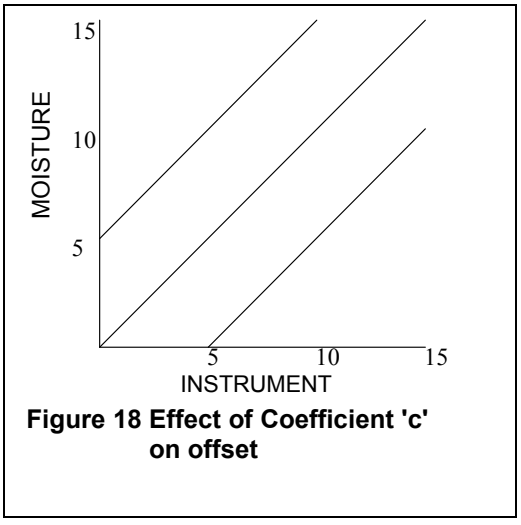

Figure 18 Effect of Coefficient 'c' on offset

Sampling is performed using the calibration program exactly as in the offset method. Using the drop down menu in the upper center box, select linear.

After pressing ‘Recalculate coefficients’, notice both ‘b’ and ‘c’ will change.

A linear regression should only be performed on data with an adequate range, typically at least a 2% absolute range.

Running a linear regression on static product samples is often a good way of establishing a slope. When the instrument is then placed on-line, the offset method may be best to bring the results into the correct range.

5 Instrument Options

The basic instrument may be enhanced by the purchase of a variety of options. These include software packages, special interface protocols, and hardware accessories. The scope of this chapter is to describe the common options and any wiring and pneumatic connections that may be necessary in order to implement those options.

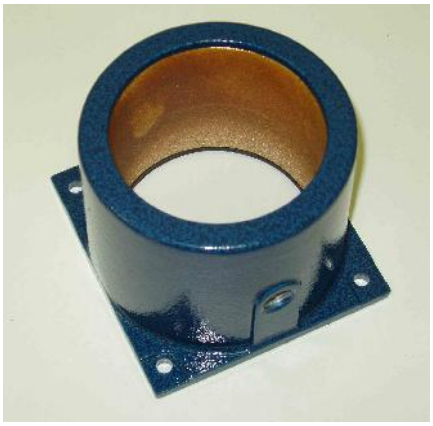

Figure 15 Light Tube

Light Tube This accessory is highly recommended to keep the instrument window clean and dust-free. The light tube mounts to the bottom of the sensor with (4) M6 screws. The screws are provided with the light tube.
In many cases the light tube will do a good job without any air-purge but in extremely dusty environments, air purging is recommended. The light tube comes with a quick-fit pneumatic fitting to accept a ¼" plastic air line. If metal piping is used, a compression fitting may be used. The light tube takes a ¼" NPT fitting.
The light tube contains a sintered phosphor-bronze lining which uniformly distributes the air within the tube. In order to avoid turbulence, air pressures should not exceed 5psi (0.3Bar). Turbulence may cause increased buildup on the window. Air should be clean and dry.

Figure 16 Flush-Mount View Window

Flange-Mount Window Type 316 stainless steel flange with 50mm view port. Window materials include quartz and sapphire for maximum abrasion resistance.

Figure 17 Sight Tube

Sight Tube Mounts directly to sensor providing angled window in contact with product flow. Materials: 316 stainless steel and sapphire window. Tube mounts to flange with sanitary clamp fitting to allow adjustable depth of penetration.

Figure 18 Pneumatic Sampler

Pneumatic Sampler Typically mounted through wall of vertical chute. Gravity fed granular materials are captured in sample cup. Fill-time, Sample-time and purge-time are all user programmable. Requires clean/dry air supply of 80psi (5Bar).

Figure 23 Air Cooling Panel

Figure 24 Water Cooling Panel

Cooling Panel Significantly reduces internal gauge temperature. Both water cooling and Vortex air cooling are available.

5.1 Vortex Cooling Panel Connections

The Vortex cooling panel is supplied with various components and requires some assembly. The following photographs show the correct sequence of assembly.

Photo shows Model #828 cooling panel with included air fittings and Vortex tube.
Use PTFE sealing tape on all connections.

Screw 90° elbow fitting into left threaded port on side panel until almost fully tight, but with elbow aligned as shown at left.

Screw Vortex Tube on to other end of elbow and fully tighten with Vortex inlet pointing down as in photo.

Rotate elbow fitting a further 90° so that Vortex tube is vertical and inlet pipe is on left side.

Screw muffler into right threaded port on side panel and fully tighten.

Figure 19 Attaching Vortex Tube and Air Fittings